

Marsaw P.F. Establishing the industrial education needs  
of the secondary schools in Worcester, Massachusetts  
1946

Service Paper

MASTER'S PAPER

ESTABLISHING THE INDUSTRIAL EDUCATION  
NEEDS OF THE SECONDARY SCHOOLS IN  
WORCESTER, MASSACHUSETTS

BOSTON UNIVERSITY  
SCHOOL OF EDUCATION

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BOSTON UNIVERSITY  
SCHOOL OF EDUCATION

MASTER'S PAPER  
ESTABLISHING THE INDUSTRIAL EDUCATION NEEDS  
OF THE  
SECONDARY SCHOOLS  
IN  
WORCESTER, MASSACHUSETTS

Submitted by  
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In partial fulfillment of requirements for  
the degree of Master of Education

1946

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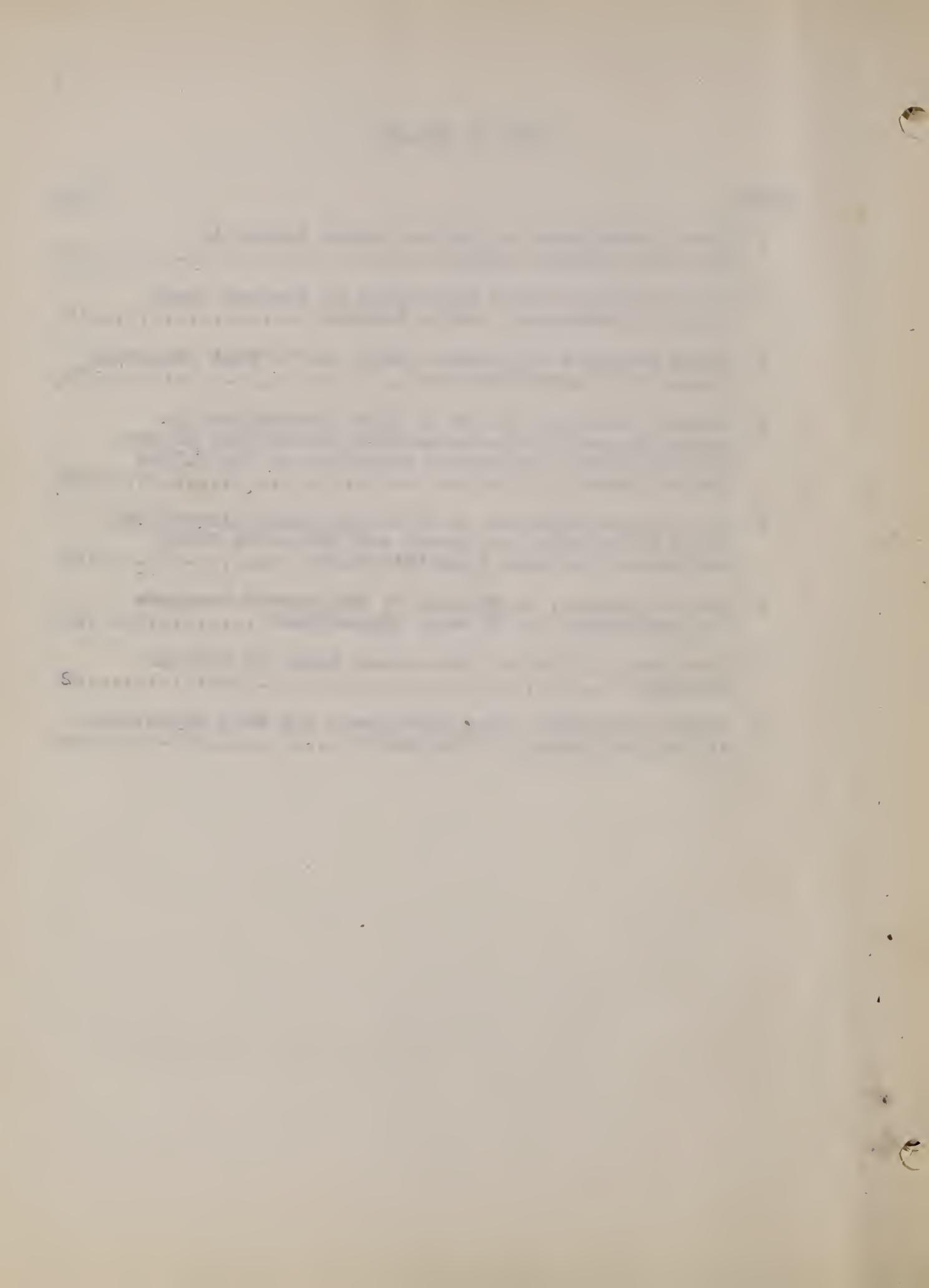
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## CHAPTER I

### THE PROBLEM

#### History of the Problem

Industrial education in America.-- Industrial education in our public schools was originally patterned after the early schools of Russia, France, England and Germany.<sup>1/</sup> Early education of this type took the form of graded exercises which each pupil was required to complete in a logical sequence. As time passed and schools became "public" in the true sense of the word, education changed to meet the needs of the masses rather than of individuals. Industrial education was slow to follow but gradually it has worked away from the assigned problem and tends to give projects which will have greater interest appeal for the pupil and will integrate with the work in the other subjects of the curriculum. Industrial education has separated into two branches known as Vocational Education and Industrial Arts. Each of these branches has specific objectives and duties to the community but each needs to co-operate with the other and their work needs to be co-ordinated so as to improve the industrial education offering in each community.

<sup>1/</sup> Charles Alpheus Bennett, History of Manual and Industrial Education 1870 to 1912. The Manual Arts Press. Peoria, Illinois, 1937, p. 402-463.



Vocational Education.-- Trade schools were started in America about 1900 and have continued to grow and expand until most of our nation is now served by trade or vocational schools. The main objective of the vocational schools is to give specific training in preparation for occupational employment. Vocational schools are supported to a large extent by federal and state funds.

Industrial Arts.-- The original plan of having, in public schools, skill training in industrial techniques has taken the form of "Manual Training" or "Industrial Arts". Manual Training is more specific training and is based largely on woodworking and mechanical drawing while Industrial Arts tends to give more general training in many fields of industrial endeavor. To quote Charles Alpheus Bennett<sup>1/2</sup>: "In the term industrial arts, the "industrial" is emphasized, while --- in the term manual training, "manual" is the important word."

Industrial Arts is a part of general education and its main objectives are to furnish exploratory experiences for the pupils and to provide for the pupils' knowledge of characteristics of materials and methods of manufacture, as well as to develop some skill in the use of fundamental tools of industry and mechanics. The operation of industrial arts courses depends upon local initiative and support.

1/2 Bennett, op. cit., p. 455.



Industrial education in Worcester.-- The first shop classes were held in the Classical High School on Walnut Street in September 1895 and were for high-school freshmen. This expanded and now classes are held for all pupils from grade five through grade twelve. The Worcester Boys' Trade School was founded in 1909 as a school for training shop apprentices. The Worcester Girls' Trade School was established in 1911.

#### Reasons for This Study

Opinion of industrialists.-- In 1921 there was an attempt on the part of the Superintendent, Doctor Harvey S. Gruver to establish a technical high school and provide adequate training facilities for Worcester's youth. His efforts were opposed by industrialists who were associated with the trade schools because it was felt that there would be useless duplication of equipment and that the trade schools could provide all the industrial education needed.

Recent years have shown a change of attitude in respect to the industrial-arts activities and many organizations have expressed in their meetings their belief that more facilities should be provided for general industrial training. The Worcester Chapter of the Society of Tool Engineers expressed this attitude in 1940. Since this time other organizations have been considering the advantages of increased industrial education.



Opinion of educators.-- Educators in Worcester have recognized the lack of adequate exploratory and avocational shop work in our secondary schools. Many have advocated an expanded industrial-arts program. Mr. Calvin H. Andrews, principal of the High School of Commerce, has been especially outspoken in this respect.

#### Plan of Procedures

Reason for study.-- To justify the expenditure necessary for establishing a technical department in the Worcester Public Schools, mere opinion is not sufficient. Therefore, an attempt has been made to establish, by logical steps, the needs of the community and to determine whether a technical department would meet these needs or whether facilities already available are sufficient.

Outline of procedure.-- This study is divided into four major parts:

1. Analysis of present facilities.
2. Analysis of community needs.
3. Analysis of offerings in other schools.
4. Conclusions and recommendations.

Outline of methods.-- Analysis of present facilities has been carried out by interviews with principals of schools, by securing statistics from the school-department office, from school reports, and by observation and study within the schools considered.



Analysis of community needs have been made by securing the approximate numbers employed in various local occupations and determining the qualifications and training necessary for these occupations.

Analysis of technical-high-school offerings have been made by securing catalogues, hand books and courses of study from a number of technical high schools throughout the United States. The courses have been summarized and the offerings catalogued.

The training and qualifications for employment in Worcester have been compared with offerings that could be made with the present facilities. Where there are not sufficient facilities and courses available, additional have been recommended.

and the first time I have seen it. It is a  
large tree, with a trunk about 10 feet in  
diameter, and a height of about 40 feet.  
The bark is smooth and greyish-white,  
with some small lenticels. The leaves  
are large, elliptical, and pointed at the  
tip, with serrated edges. The flowers  
are small, white, and bell-shaped, with  
five petals. The fruit is a small, round  
seed pod, containing several seeds.  
The tree is found in a forest near a  
small stream, and appears to be in good  
health. The surrounding vegetation  
includes various shrubs and smaller  
trees, such as birches and maples.

## CHAPTER II

### PRESENT FACILITIES

#### Training Facilities Available

Grammar schools.-- To serve Grades VII and VIII in Worcester's 54 public grammar schools, there are seven strategically located shops. Pupils attend these shops one and one-half hours per week and some pupils travel as much as three miles to reach these buildings. The shops are fundamentally woodworking but are being broadened by the addition of printing, electricity, metal working, home mechanics and craft work. Pupils in the preparatory grammar schools, Grades VII and VIII, are not required to take shop work but may attend these classes if they so desire. At the present time, less than 25 per cent of the preparatory school students take shop work.

Junior high schools.-- Worcester's two junior high schools contain Grades VII, VIII and IX. The length of time that the pupils attend the classes varies with the schools and with the grade of work. All except preparatory pupils are required to take some form of shop work in each grade. The pupils are required to pass through these shops in a prescribed rotation, spending 20 weeks in each shop. In Grade IX, however,



they may choose not more than two of the areas for specialized work. All shops are on the general unit plan and are in five basic areas -- woods, metals, printing, home mechanics and drawing.

Senior high schools.-- Worcester's four senior high schools include Grades IX through XII and, since they differ considerably within themselves, they will be discussed individually:-

1. Classical High School contains one drawing room with a capacity of 120 pupils per term.
2. The High School of Commerce contains within its building one radio room and radio laboratory and two mechanical drawing and blueprinting reading rooms. The capacity of each of these rooms is approximately 144 pupils per term.
3. North High School contains two drawing rooms with a capacity of 120 pupils each per term.
4. South High School contains two drawing rooms with a capacity of 120 pupils each per term, plus a shop for freshmen. This shop is basically woodworking but is also used for shop drawing and hobbycraft work. The maximum capacity is 96 pupils per term.

Classical High School, The High School of Commerce and North High School send all of their shop pupils to the

and the following year we had a good harvest and  
we had no lack for money. This was the first time  
we had a surplus over our living expenses.

On December 2nd

we left the ranch and started back to town.  
We were anxious to get home.

We reached town about noon and I went to the hotel

and sent a telegram to my wife telling her we would be home Saturday.

We got home Saturday evening and I was very glad to see my wife.

The next day we took a walk around the country

and I found a place where we could get some water.

We stopped there and I washed my clothes.

We then continued on our way to town.

We reached town about 4 o'clock in the afternoon.

We had dinner at a restaurant and then I went to the

post office to mail a letter.

I then went to the hotel and had a cup of coffee.

We then went to the ranch and I helped my wife

wash the clothes and then we had dinner.

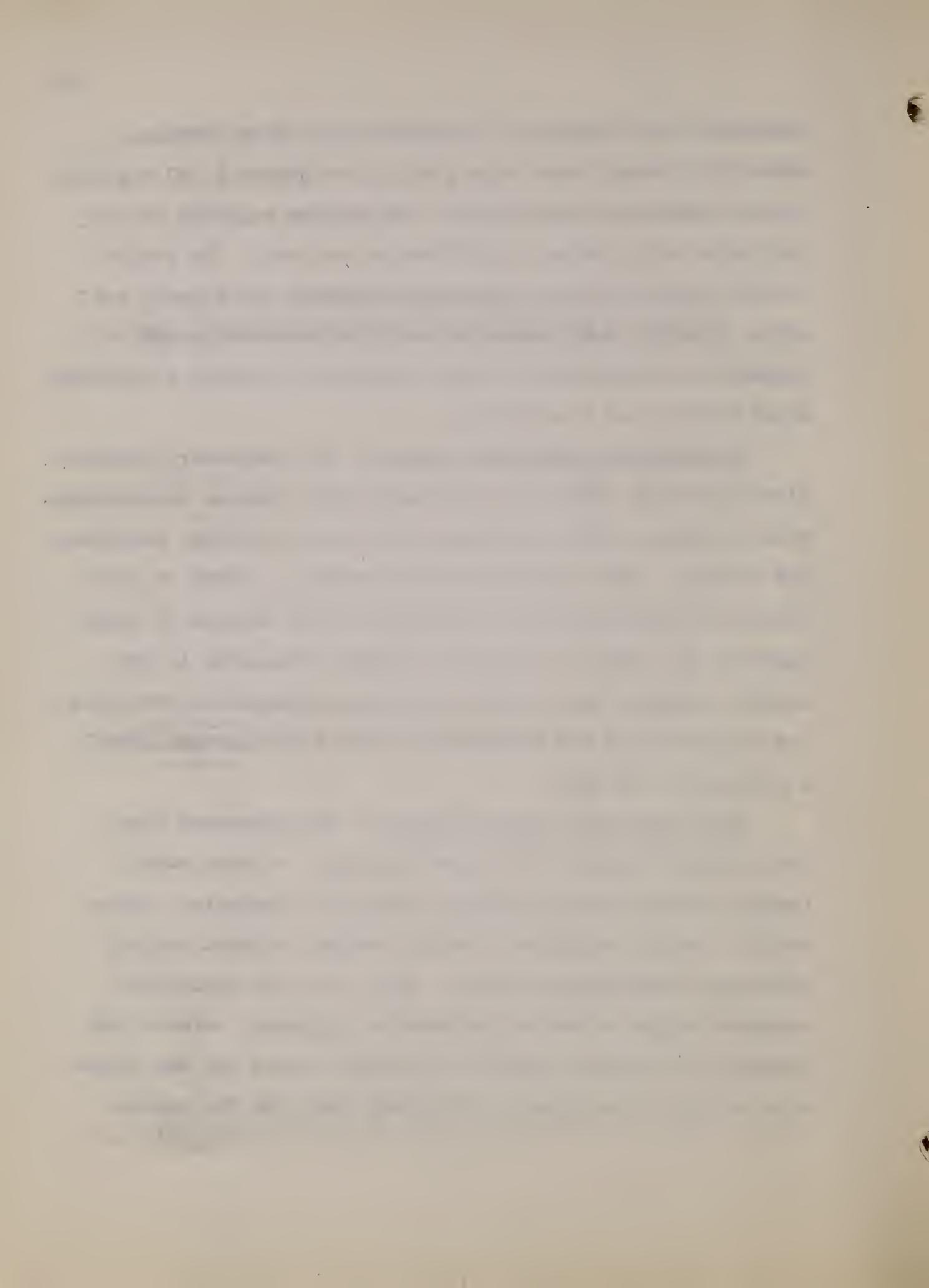
We then went to bed and I slept well.

Industrial Arts Center for woodworking and shop drawing.

South High School sends shop pupils from Grades X, XI and XII to the Industrial Arts Center. The maximum capacity of the Industrial Arts Center is 392 pupils per term. The pupils attend classes at this center approximately 200 minutes per week. The shop work consists mostly of woodworking and mechanical drawing but is being expanded to include elementary metal working and electricity.

Continuation-Vocational school.-- The Worcester Continuation-Vocational School has six shops which include woodworking, metal forging, metal machining, sheet metal working, printing, and drawing. This school has two purposes, - first to give advanced handwork and tool training to boys capable of doing shopwork but unable to maintain academic standards in prescribed courses, and second to provide continuation schooling for boys employed but required by state law to attend school a portion of the time.

Boys' and Girls' Trade schools.-- The Worcester Boys' Trade School includes the following shops, - sheet metal, forging, machine shop, welding, automotive mechanics, electricity, radio, carpentry, pattern making, cabinet making, printing, drafting and design. There are also associated academic subjects such as mathematics, grammar, science and history. The work is carried on in unit shops and the objective or aim of the school is to train boys for the trades.



The Worcester Girls' Trade School is conducted in the same manner as the Boys' Trade School but the emphasis is upon home making, dress making, dress design, cosmetology, sales, printing, dietetics and food preparation.

The Worcester Evening High School.-- The Worcester Evening High School has no shop or mechanical drawing facilities available at the present time.

#### Enrollment

School and shop enrollment.-- A comprehensive summary of the school enrollment and industrial arts shop enrollment is given in Tables 1 and 2.

Table 1. School Enrollment on Various Grade Levels in Worcester Public Schools. (Male only).

Schools	Enrollment						
	Grade						
	7	8	9	10	11	12	Total
GRAMMAR SCHOOLS							
30 Regular	412	469					881
4 Preparatory	99	106					205
Total	511	575					1086
JUNIOR HIGH SCHOOLS							
Grafton Street	206	142	166				514
Providence Street	99	95	84				278
Total	305	237	250				792
SENIOR HIGH SCHOOLS							
Classical		70	146	110	78		404
Commerce		162	242	229	173		806
North		158	161	128	97		544
South		232	118	104	51		505
Total		622	667	571	399		2259
EVENING HIGH							478



Table 2. Industrial Arts Shop Enrollment on Various Grade Levels in Worcester Public Schools.

Schools	Enrollment						
	7	8	9	10	11	12	Total
GRAMMAR SCHOOLS							
30 Regular	412	469					881
4 Preparatory	27	20					47
Total	439	489					928
JUNIOR HIGH SCHOOLS							
Grafton Street	177	134	109				420
Providence Street	94	93	80				267
Total	271	227	189				687
SENIOR HIGH SCHOOLS							
Classical		4	7	1	0		12
Commerce		74	98	46	35		253
North		12	3	1	1		17
South		44	11	4	2		61
Total		134	119	52	38		343



## CHAPTER III

### PREPARATION FOR THE INDUSTRIAL SURVEY

#### Preliminary Facts and Observations

Reasons for the survey.-- To justify any recommendation for technical training in the Worcester Public Schools, it is necessary to establish first the technical training needs of the city. This can be accomplished by determining the occupations of Worcester's employees and the training required for these occupations.

Preliminary observations.-- Worcester, a city of approximately 200,000 is primarily a manufacturing city. The occupations vary greatly as to skill, education and experience required. Even within one type of occupation, there may be many levels of skill and achievement. It seemed that the logical person to approach for information concerning training needs of employees was the employment manager.

Sources of material.-- Because of the active interest of many local organizations in employment problems, it would be assumed that some might have information concerning the occupations in Worcester, numbers employed in these occupations and qualifications for employment in various occupations.



### Securing Information

Visits to local organizations.-- The Metal Trade Association had no information which would help in this matter. The Industrial Bureau of the Worcester Chamber of Commerce had only meager statistics from the Massachusetts Department of Labor and Industries. Other local organizations contributed nothing additional.

Massachusetts Department of Labor and Industries.-- Following a cue from the Chamber of Commerce, a letter was sent to the Department of Labor and Industries for an appointment. The appointment was made and an interview ensued. Much valuable information was received concerning the industries of Worcester. Some of the data was not current but any change would be quite negligible. One bulletin<sup>1</sup>/carried the following information:

<u>City Worcester</u>	<u>Number of Establishments</u>	<u>Number of Wage Earn- ers. Week of 8/15/45</u>
Manufacturing	133	27,989
Wholesale and Retail Trade	130	4,448
Public Utilities	4	1,532
Construction	33	497
Municipal Employment	1	975
All Other Classes	<u>37</u>	<u>2,623</u>
Total	338	38,064

1/ Employment and Pay Roll Earnings in 14 Leading Cities (August, 1945). Commonwealth of Massachusetts, Department of Labor and Industries, Division of Statistics. Boston, Massachusetts. Folio: Cities No. 8--1945, 3p.



Another bulletin<sup>1/</sup> carried a list of 22 products manufactured in Worcester in 1943. Omitting two items (bakery products and surgical appliances) the following 20 were selected for study:

- |   |  |
|---|--|
| 1. Machine tools                                  | 11. Boots and shoes, other than rubber.  |
| 2. Abrasive wheels, stones, and related products. | 12. Stamped and pressed metal products   |
| 3. Steel and rolling-mill products                | 13. Machine-tool accessories             |
| 4. Iron and steel forgings                        | 14. Envelopes                            |
| 5. Foundry and machine-shop products              | 15. Printing and publishing              |
|   | 16. Firearms                             |
| 6. Wire and wirework                              | 17. Structural and ornamental metal work |
| 7. Screw-machine products                         |  |
| 8. Leather and leather belting                    | 18. Knit goods                           |
| 9. Woolen and worsted goods                       | 19. Tools                                |
| 10. Textile machinery and parts                   | 20. Carpets and rugs, wool               |

United States Employment Service.-- A letter to the state office of the United States Employment Service in Boston brought the reply that "--- the records as compiled by our organization are on an industrial rather than an occupational basis."

Other sources.-- A check with the Federal Reserve Bank of Boston and with the Associated Industries of Massachusetts

<sup>1/</sup> Census of Manufacturers - 1943 - City of Worcester, Massachusetts. Commonwealth of Massachusetts, Department of Labor and Industries, Division of Statistics. Boston, Massachusetts. Folio: Manufacturers 1943 - No. 39, 5p.



provided no occupational information although both had conducted surveys recently.

Direct Survey.-- The only remaining methods of securing the numbers employed in various occupations seemed to be by direct contact and by questionnaire.

With just 1000 words the following will do much to  
clarify the situation existing now and — if you will  
not mind having it cut down to fit — I hope that sufficient  
material may be found among them.

## CHAPTER IV

### THE INDUSTRIAL SURVEY

#### Choice of Industries and Occupations

Choice of industries.-- From a list of industries of Worcester, the larger firms were selected for survey in each of the 20 occupational classifications. Industries selected are shown in table below.

Table 3. Firms Selected for Survey Under the 20 Most Important Industrial Classifications.

Classification	Firms Selected
1. Machine Tools	Reed and Prince Company Reed-Prentice Corporation Leland-Gifford Company John Bath Company
2. Abrasive Stone and Wheels	Norton Company
3. Steel and Rolling Machine Products	American Steel and Wire Company
4. Iron and Steel forgings	Stafford Iron Works Wyman-Gordon Company Saint Pierre Chain Corporation Armours Pattern Shop Washburn Shops
5. Foundry and Machine Shop Products	Wickwire Spencer Corporation Worcester Wire Works Washburn Co.
6. Wire and Wirework	Ramsdell Tool Works Olson Manufacturing Company Graton and Knight Company Warren Leather Goods Company
7. Screw Machine Products	Coe Woolen Company The Bell Company
8. Leather and Leather Products	
9. Woolen and Worsted Goods	



Table 3. (concluded)

Classification	Firms Selected
10. Textile Machinery	Crompton and Knowles Loom Works
11. Boots and Shoes	Heywood Boot and Shoe Corporation
12. Stamped and Pressed Metal	Worcester Pressed Steel Company
13. Machine Tool Accessories	Worcester Stamped Metal Company
14. Envelopes	Reed Small Tool Company
15. Printing and Publishing	United States Envelope Company Logan, Swift and Brigham Company Worcester Telegram and Evening Gazette Davis Press Commonwealth Press
16. Firearms	Harrington-Richardson Arms Company
17. Structural Steel	Eastern Bridge Company
18. Knit Goods	Worcester Knitting Company
19. Tools	Worcester Tool and Die Company The Heald Machine Company
20. Carpets and Rugs (wool)	M. J. Whittall's Associates Incorporated

United States Census figures.-- A study of the United States Census<sup>1/</sup> revealed that 66.6 per cent of those employed in Worcester in 1940 were in 18 general occupations. Table 4 shows the percentage of the working population of Worcester employed in each of these 18 occupations. These data were not considered sufficiently accurate for current conditions and were used only for comparison, but included in this report because they may give a better indication of post-war employment than current figures acquired by an industrial survey considering the unsettled labor conditions.

<sup>1/</sup> Sixteenth Census of the United States. Department of Commerce, Washington, D. C. Vol. 3, Pt. 3, p. 508-512.

1880-1881

and then we

were given a room in a house which was to be our home for the next few days.

It was

an old house

but

the room was very comfortable and we were very happy to have a place to stay in.

We had a good time there and enjoyed ourselves very much.

We were very happy to be able to stay in such a nice place.

We were very happy to be able to stay in such a nice place.

We were very happy to be able to stay in such a nice place.

Table 4. Numbers Employed in the 18 Major Occupations in Worcester and the Corresponding Percentages of the Total Employed Population.<sup>1/</sup>

Occupation (1)	No. Employed (2)	Percentage of Total Employment (3)
Clerks, Stenographers and Kindred	8,200	16.98
Salesmen	382	0.80
Mechanical Engineers	333	0.69
Designers	61	0.13
Draftsmen	357	0.74
Shop Superintendents and Officials	878	1.82
Shop Foremen	937	1.94
Carpenters	646	1.34
Electricians	296	0.61
Machinists	3,258	6.75
Mechanics	1,185	2.45
Molders	332	0.69
Painters	571	1.18
Patternmakers	125	0.26
Plumbers	261	0.54
Printers	394	0.82
Operators	13,271	27.48
Shipping and Receiving Clerks	676	1.40

<sup>1/</sup> The percentages in this table are based on a total male employment figure given by the United States Census as 48,288. Loc. cit.

Choice of occupations.-- After studying the information given in Table 4, an interview was arranged with an employment manager of one of the larger companies. This employment manager (who prefers to remain anonymous) said that the classifications, as given in Table 4, would be difficult to handle in local situations and suggested that the occupations be broken down into pay roll classifications. With this in

the first time in the history of the world, the  
whole of the human race has been gathered  
together in one place, and that is the  
present meeting of the General Assembly.  
The whole of the human race has been  
gathered together in one place, and that is  
the present meeting of the General Assembly.  
The whole of the human race has been  
gathered together in one place, and that is  
the present meeting of the General Assembly.  
The whole of the human race has been  
gathered together in one place, and that is  
the present meeting of the General Assembly.  
The whole of the human race has been  
gathered together in one place, and that is  
the present meeting of the General Assembly.

mind, the occupations were re-worded and arranged as follows:

Clerks and Stenographers	Machinists and Mechanics
Salesmen	Molders
Sales Engineers	Painters
Designers	Patternmakers
Draftsmen	Plumbers
Shop Superintendents	Printers
Shop Foremen	Related Non-Mechanical
Electricians	

#### Forms and Methods

Industrial inquiries.-- To secure information which would help in estimating the numbers employed in various occupations, an inquiry form was developed.<sup>1/</sup> This form listed the 15 occupations mentioned above and was accompanied by a letter<sup>2/</sup> addressed to the employment manager asking him to fill in the numbers employed in each occupation; also the total numbers employed by the concern. This letter and inquiry form were sent to 33 of the industries previously listed. Personal contact was made with three of the industries and the form was filled in during an interview with the employment manager.

Employment requirements.-- A special form<sup>3/</sup> was developed to facilitate interviewing employment managers concerning the desired training for employees in various occupations. The employment manager was given a sheet which listed a grading of

1/ See Appendix - page 43..

2/ See Appendix - page 44.

3/ See Appendix - page 45..



each ability. The interviewer had previously selected a number of occupations and inserted them in spaces at the top of his "Analysis of Occupations Check Sheet".<sup>1/</sup> As the employment manager considered each ability required for each occupation, he was asked to give it a numerical rating according to the rating sheets. The interviewer drew a line on his check sheet opposite this numerical value under the specified occupation. Every occupation was covered at least twice in interviews of this nature.

1/ See Appendix - page 48.

and  $\int_{\Omega} \phi_{\epsilon}^2 \nabla \phi_{\epsilon} \cdot \nabla \psi_{\epsilon} \rightarrow 0$  as  $\epsilon \rightarrow 0$ . This implies that  $\phi_{\epsilon}$  converges weakly in  $L^2(\Omega)$  to some function  $\phi$ . Since  $\phi_{\epsilon} \geq 0$ , we have  $\phi \geq 0$ . By the weak lower semicontinuity of the  $L^2$ -norm, we have  $\|\phi\|_{L^2(\Omega)} \leq \liminf_{\epsilon \rightarrow 0} \|\phi_{\epsilon}\|_{L^2(\Omega)}$ . On the other hand, since  $\phi_{\epsilon} \geq 0$  and  $\phi_{\epsilon} \rightarrow \phi$  a.e. in  $\Omega$ , we have  $\phi \geq 0$  and  $\phi = \lim_{\epsilon \rightarrow 0} \phi_{\epsilon}$  a.e. in  $\Omega$ . Therefore,  $\|\phi\|_{L^2(\Omega)} = \lim_{\epsilon \rightarrow 0} \|\phi_{\epsilon}\|_{L^2(\Omega)}$ .

Since  $\phi_{\epsilon} \rightarrow \phi$  a.e. in  $\Omega$ , we have  $\phi_{\epsilon} \rightarrow \phi$  in  $L^1(\Omega)$ .

## CHAPTER V

### RESULTS OF INDUSTRIAL SURVEY

#### Occupational Survey

Results of occupational inquiry.-- The 22 industries which answered the inquiry showed an employment of 16,207 (of which 10,894 were male). Figures from the Massachusetts Department of Labor and Industry showed a total employment of 30,984 in Worcester for February. Table 5 shows the reported employment in each

Table 5. The Numbers Employed in 15 Occupational Classifications as Reported on Survey and Estimated Total Employment in These Classifications. (Male only).

Occupation (1)	Number Reported (2)	Total Estimated (3)
Clerks and Stenographers	515	984
Salesmen	487	931
Sales Engineers	57	109
Designers	67	128
Draftsmen	192	364
Shop Superintendents	47	90
Shop Foremen	421	804
Electricians	148	283
Machinists and Mechanics	4147	7929
Molders	109	208
Painters	56	107
Patternmakers	90	172
Plumbers	34	65
Printers	206	394
Related Non-Mechanical	4318	8256
Total	10894	20824



occupation as well as the estimated numbers.

The estimated numbers were secured by multiplying the reported number by a previously determined constant. This constant was found to be 1.912 and was secured by dividing the total number employed in Worcester (30,984) by the total number reported (16,207). For an example consider the salesmen group (487 reported). The estimated number for column three was found by multiplying  $1.912 \times 487 = 931$ .

#### Qualifications for Employment

Qualifications survey. -- Using the previously mentioned check sheet and rating sheets<sup>1/</sup> in interviews with employment managers, qualifications for specific occupations were listed. If there were disagreement between two employment managers concerning any specific rating, this occupation was discussed with a third employment manager. This happened in only two cases. Results of this study are given in Table 6 and it is interesting to note that these men considered that two years is the minimum high school training desirable. When studying this table it is well to keep in mind that a technical high school would provide training in bench tool work, advanced mechanical drawing, shop mathematics, grammar, composition, and science corresponding to number ratings in Table 7 as follows: Manual - 2, Drawing - 5, Mathematics - 5, Reading - 2, Writing - 2, Science 3.

<sup>1/</sup> See Appendix - pages 45-49.



Table 6. Qualifications, As Desired by Employment Managers,  
for Employment in 15 Basic Occupations.

Occupations	Qualifications <sup>1</sup>									
	1	2	3	4	5	6	7	8	9	10
Machine Designers	1	1	1	1	1	1	1	1	1	1
Draftsmen	1	1	1	1	1	1	1	1	1	1
Engineers	2	2	2	2	2	2	2	2	2	2
Salesmen	2	2	2	2	2	2	2	2	2	2
Clerks and Stenographers	2	2	2	2	2	2	2	2	2	2
Shop Superintendents	5	1	1	1	1	1	1	1	1	1
Shop Foremen	4	1	1	1	1	1	1	1	1	1
Machinists	5	1	1	1	1	1	1	1	1	1
Mechanics	4	1	1	1	1	1	1	1	1	1
Electricians	2	1	1	1	1	1	1	1	1	1
Patternmakers	3	2	1	1	1	1	1	1	1	1
Molders	1	1	1	1	1	1	1	1	1	1
Plumbers	3	1	1	1	1	1	1	1	1	1
Painters	1	1	1	1	1	1	1	1	1	1
Non-Mechanical Occupations	1	-	1	1	1	1	1	1	1	1

Comments by employment managers.-- Comments made by employment managers in these interviews included: - Employees in industry should possess a "good mechanical vocabulary", they should be "willing to work", they should have an "appreciation of accuracy" and they should be "versatile". "If they possessed a broader training, they could adapt themselves to more than one job."

<sup>1</sup>/ Interpretation of the code figures used in this table may be secured by consulting the rating sheets in Appendix = pages 45-47.



## CHAPTER VI

### A STUDY OF OTHER SCHOOLS

#### Purpose and Methods

Reason for studying other schools.-- If recommendations concerning courses of study are to be made for the Worcester School Department, it seems wise to analyze other school systems and their courses of study. Although all school departments differ in certain respects, the general needs are common, and careful study of curriculum plans will yield much valuable information for use in formulating opinions and suggestions for procedure.

Procedure.-- The study of other schools was accomplished by following these steps:

1. Establishing a list of technical schools.
2. Writing to schools on established list.
3. Cataloging information received.
4. Analyzing information as it might apply to Worcester.

Establishing list of schools.-- A very fine listing of technical high schools and training schools was found.<sup>1/</sup> Because of previous knowledge of certain technical schools and

<sup>1/</sup> Homer L. Patterson, Patterson's American Educational Directory. Vol. XLII. American Educational Company. Chicago, Illinois, p. 710-717.



information gained from other sources, the following fifty schools were chosen for this study:

<u>STATE</u>	<u>CITY</u>	<u>SCHOOL</u>
Alabama	Tuskegee	Tuskegee Institute
	Birmingham	Alabama Boys' Industrial School
California	San Francisco	California School of Mechanical Arts
	San Francisco	Lux Technical Institute
	Los Angeles	Manual Arts High School
	Oakland	Technical High School
Colorado	Denver	Manual Training High School
Connecticut	New London	Chapman Technical High School
District of Columbia	Washington	Columbia Technical Institute
	Washington	McKinley Manual Training School
Georgia	Atlanta	Technological High School
Illinois	Chicago	Chicago Technical College
	Chicago	Crane Technical High School
	Chicago	Harrison Technical High School
	Chicago	Lane Technical High School
	Glenwood	Glenwood Manual Training School
Indiana	Indianapolis	Emmerich Manual Training High School



<u>STATE</u>	<u>CITY</u>	<u>SCHOOL</u>
Indiana	Indianapolis	Arsenal Technical High School
Kansas	Beloit	Kansas Industrial School for Boys
Kentucky	Louisville	DuPont Manual Training High School
Massachusetts	Boston	High School of Practical Arts
	Boston	Boston Technical High School
	Cambridge	Ridge Technical School
	Springfield	Springfield Technical High School
Michigan	Detroit	Cass Technical High School
	Muskegon	Hackley Manual Training School
Minnesota	Saint Paul	Mechanics Arts High School
	Minneapolis	Boys Vocational High School
	Saint Louis	Hadley Technical High School
	Kansas City	Manual High and Vocational School
Nebraska	Omaha	Technical High School
New Jersey	Newark	East Side Commercial and Technical High School
	Trenton	Trenton School of Industrial Arts
New York	Syracuse	Blodgett Vocational High School



<u>STATE</u>	<u>CITY</u>	<u>SCHOOL</u>
New York	Bronx	Bronx Vocational High School for Boys
	Brooklyn	Brooklyn Technical High School
	Rochester	Edison Technical and Industrial High School
	Buffalo	Technical High School
Ohio	Cleveland	East Technical High School
	Cleveland	West Technical High School
	Dayton	Parker Vocational High School
	Toledo	Woodward Technical High School
Pennsylvania	Scranton	Technical High School
Tennessee	Memphis	Memphis Technical High School
Texas	Dallas	Crozier Technical School
	Fort Worth	Technical High School
Virginia	Hampton	Hampton Institute
Washington	Seattle	Edison Vocational High School
Wisconsin	Milwaukee	Boys Technical High School
	Menomonie	Stout Institute

Letter to schools.-- A letter<sup>1/</sup> was drafted asking for any books, courses of study and other printed material which would apply to the problem. The letter was mailed to the fifty chosen schools on December 10, 1945.

1/ See Appendix page 43.



### Results of Survey

Replies to letter.-- Forty-five of the schools contacted responded with letters and literature. These letters were very helpful and frequently contained information which assisted materially in analyzing the problem. The literature varied from one mimeographed sheet to a set of three very well printed and illustrated booklets. Some of the better handbooks were printed in the school print shops. Four schools that replied could not be used in the final analysis because Chicago Technical College, Hampton Institute and Stout Institute are institutions on a higher level than the technical work to be covered in this survey and Lux Technical Institute is a school for girls. Ten of the schools did not send sufficient data to be considered in the final analysis.

Areas of shop work.-- A study of the 31 schools submitting sufficient information to be included in this survey showed the frequency with which certain shop areas appeared in school planning. This frequency is indicated in Table 7.

Table 7. Frequency of Typical Shop Areas Among 31 Schools Surveyed

Type of Area	Number of Schools
Machine Work	31
Woodwork	31
Mechanical Drawing	31
Electricity	30
Auto Mechanics	21

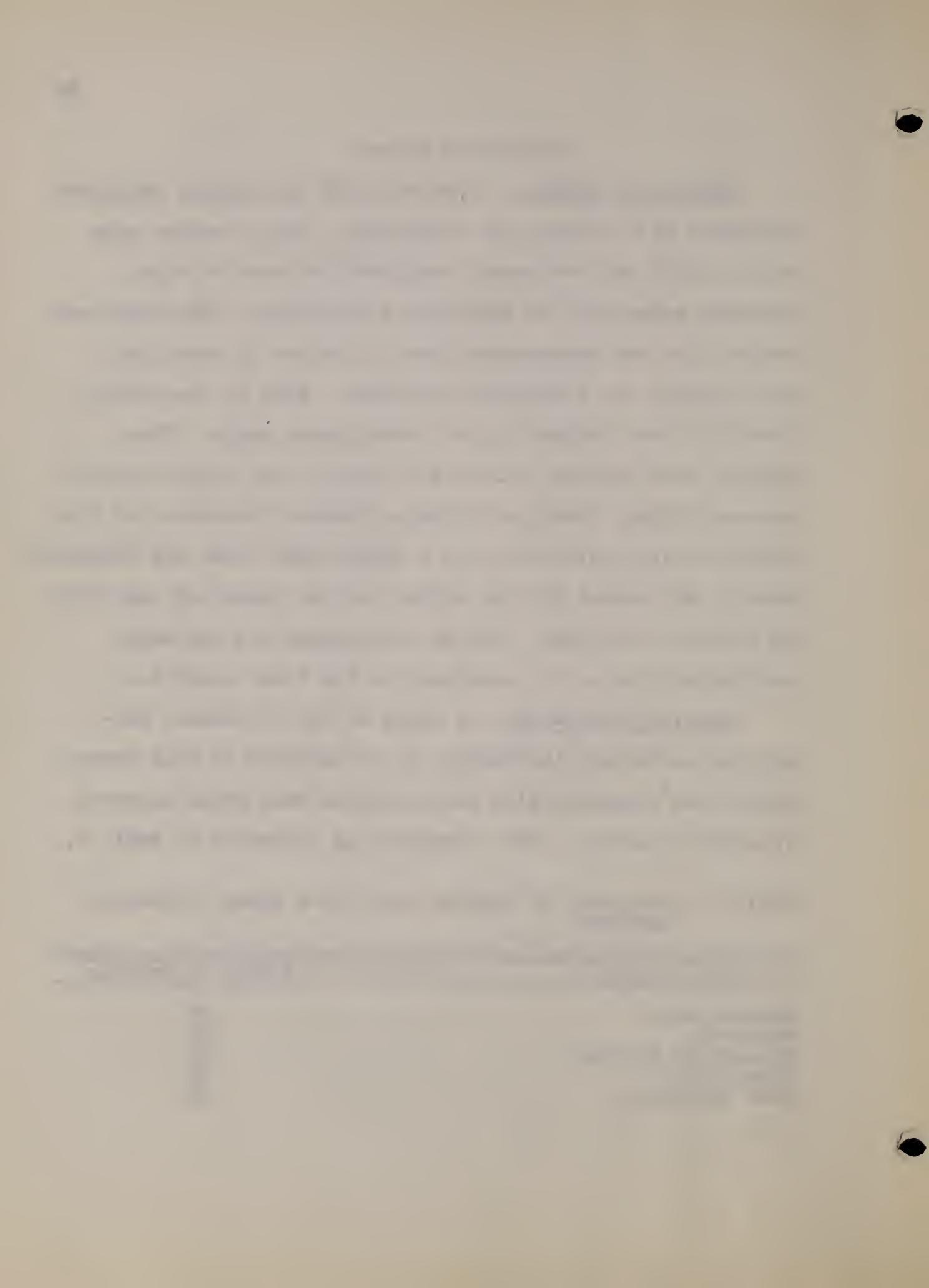


Table 7. (concluded)

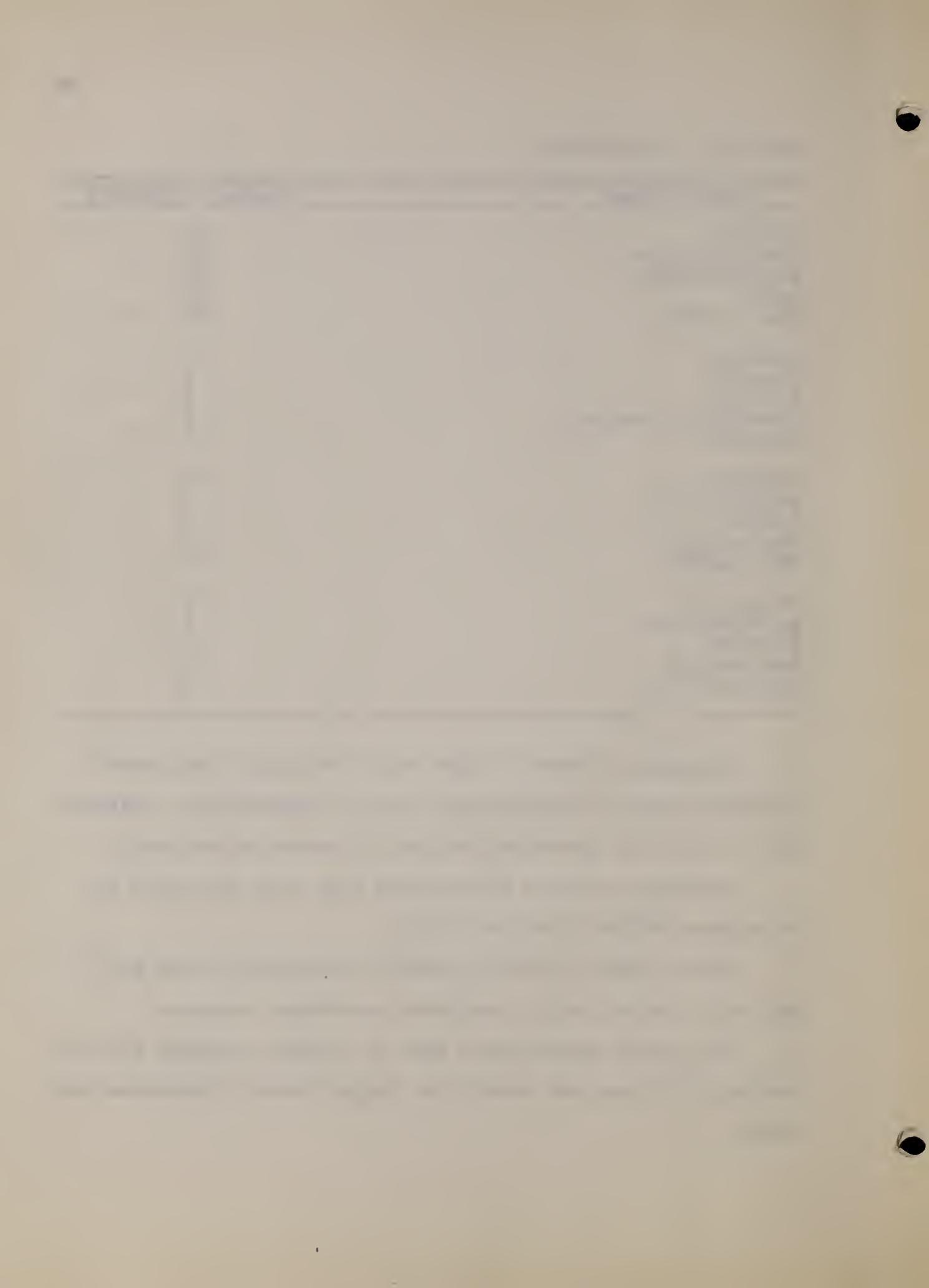
Type of Area	Number of Schools
Printing	19
Commercial Art	19
Aero Mechanics	18
Radio	17
Sheet Metal	14
Welding	7
Foundry	4
Forging	4
Industrial Chemistry	3
Painting	3
Plumbing	3
Refrigeration	3
Crafts	2
Photography	2
Shoe Repair	2
Tailoring	2
Horticultural	1
Plastics	1
Watchmaking	1
Upholstering	1

Comments.-- Further study showed that only one school (Emmerich Manual Training High School, Indianapolis, Indiana) did not list an electrical course. (Worcester has none).

Fourteen of the 31 schools had both boys and girls in attendance while 17 had only boys.

Twenty-eight of the 31 schools conducted college preparatory courses and 24 conducted vocational courses.

One school required one year of foreign language for all students and one gave credit for Sunday School attendance and study.



Of the seven non vocational schools, six specified wood-working in grade IX and patternmaking in grade X. In grades XI and XII, three gave choice between machine shop and cabinet work. This should be emphasized as the traditional form of Manual Training. The tendency in the more modern schools is to give a more general training in many areas.

Over 50 per cent of the schools surveyed had courses in nine different areas. This would provide excellent opportunity for all pupils to secure diversified experiences of an exploratory nature. With such a plan, the pupils can choose their vocation more wisely. Compare this with Worcester which has only three areas in high school in spite of the fact that Worcester is a manufacturing city and over 70 per cent of her working population are employed in industry.

more frequently with increasing age, especially in the elderly and those with underlying disease. Some authors have suggested that the risk of stroke may be more than doubled with each decade of age. At follow-up examinations, the risk of stroke appears to increase with age, particularly among women, and it has been suggested that this could be due to increased vascular stiffness and/or increased vascular tone. However, it is also possible that the increased risk of stroke in the elderly is due to increased vascular disease. The relationship between stroke risk and age is complex, with both genetic and environmental factors playing a role. In addition, the risk of stroke increases with age, particularly in the elderly, and it is important to take this into account when considering the risk of stroke in the elderly population.

## CHAPTER VII

### SUMMARY AND RECOMMENDATIONS

#### Summary

Needs as indicated by industry.-- Data given in Chapter V shows that industry desires certain things in its employees.

1. All should have a minimum of grammar school, plus two years of high school.
2. Fifty-eight per cent should have a minimum of four years high school.
3. Eight per cent should have college training.
4. All should have fundamental tool training.
5. Forty-four per cent should have machine tool training.
6. Forty-two per cent should have specific tool training.
7. Fifty-six per cent should have one year of mechanical drawing.
8. Nine per cent should have more than one year of mechanical drawing.
9. Fifty-five per cent should have high-school algebra.
10. Eight per cent should have trigonometry.
11. Sixteen per cent should be able to read and write mechanical papers.

the following  
period of  
time will be  
spent in  
the study of  
the following  
topics:  
1. The  
various  
types of  
soil  
and  
their  
relation  
to  
crop  
production.  
2. The  
various  
types  
of  
fertilizers  
and  
their  
relation  
to  
crop  
production.  
3. The  
various  
types  
of  
pests  
and  
their  
relation  
to  
crop  
production.

Public school offerings.-- Enrollment compared with shop capacities is shown in Table 8. In addition to information given in Table 8, it is well to bear in mind that in senior high school, the shop work consists of radio and woodworking, while only an approximate 8 per cent of the employment in Worcester are in these two fields.

Table 8. Total Enrollment, Shop Enrollment and Shop Capacities in Various Schools of Worcester.

Schools (1)	Total Enrollment (2)	Shop Enrollment (3)	Shop Capacities (4)
Grammar Schools	1086	928	2520
Junior High Schools			
Grafton Street	514	420	3024
Providence Street	278	267	2016
Senior High Schools	2259	343	488
Evening High Schools	478	0	0

Trade School offerings.-- The basic occupations of Worcester are taught at the Boys' Trade School and the boys receive adequate preparation to enter specific trades. During normal times, the capacity of the trade school is sufficient to accomodate the boys preparing for Worcester's industries. The shops are well equipped and the courses are well taught. Academic training at the trade school is limited to three hours a day, compared with four hours a day in the high school. Trade training, however, should not be encouraged until the boys have established their abilities and desires through exploratory experiences in many fields.

your wife's services have been  
unavailable, we are sorry to  
inform all that she is no longer  
available for your business.

All your correspondence will be  
handled by our office, and you  
will receive the same prompt  
attention as before.

We hope you will be satisfied  
with our service, and we thank  
you for your continued support.

Very truly yours,

The [unclear] Company  
[unclear]

[unclear]  
[unclear]

Shortcomings of present facilities.-- A study of data previously given, plus information received from other sources reveals the following facts:

1. Worcester is the thirty-ninth city in size in the United States and of the cities its own size and larger, there are only six others without technical high schools. Replies to personal letters to the superintendents of these six schools revealed that all have comprehensive high school technical departments.
2. Employment in Worcester is primarily industrial.
3. Worcester has sufficient classroom space for its entire college preparatory and commercial enrollment.
4. Worcester Boys' Trade School provides adequate trade training for boys who have chosen a vocation and are qualified for admission.
5. Modern educational planning provides for a variety of exploratory experiences in Grades VII, VIII and IX, with provision for further exploratory work for some students in Grades X, XI, and XII. (The Educational Department of the State of Connecticut recommends that exploratory work be carried on through Grade X before any vocation is selected).
6. Worcester provides general exploratory experiences for all boys except preparatory students in the junior high schools.



7. General exploratory work on the secondary level terminates with the ninth grade for those pupils who attend junior high school, but there is no general exploratory work as such for the 71 per cent of seventh and eighth grade pupils who do not attend junior high school.
8. Worcester provides only narrow training (woodworking, radio and mechanical drawing) for boys who enter senior high school from the grammar schools and this constitutes approximately 71 per cent of the boys in the ninth grade.
9. The maximum capacity of all shops for boys of the ninth grade is 488. In other words, present facilities could accommodate only 23 per cent of the total enrollment.
10. With over 70 per cent of the employed population in Worcester in the mechanical vocations which should have at least two years of high school, provisions should be made for training in the basic skills of industry so as to help the pupils choose their vocational training.

Conclusions.-- From the foregoing summary, it can be seen that Worcester, an industrial city, is very much in need of training facilities for boys on the secondary school level who are not attending the junior high schools. The lack of facilities and the lack of a planned technical course in the high school have prevented proper exploratory participation by the majority of our boys and, consequently, many high school students have been unable to acquire the fundamental



skills needed for non-mechanical operations and which lay the foundation for training for avocational and vocational pursuits. Other school systems have provided adequate training facilities on the secondary level so as to provide specific preparation for technical colleges; also preparation in the fundamental skills and techniques for specific training in trade schools. Boys in Worcester have a very restricted opportunity in this respect. Industrialists, educators, employment managers and employees recognize the need of greater fundamental tool training. With these thoughts in mind, there can be but one conclusion, - Worcester needs much greater facilities for fundamental tool training in many fields on the secondary school level.

#### Recommendations

Recommendations.-- With the foregoing thoughts in mind, the following suggestions are made:

1. Development of a department on the secondary level containing woodworking, metal working, graphic arts, foundry, electricity, power, electronics and drawing areas. All areas should be so equipped as to provide fundamental training for those who have not had experiences in these fields but should also have facilities for more advanced work for those students who will not go to the vocational school but will study in the comprehensive high school



and desire special training in particular fields such as cabinet making, pattern making, architectural drawing, airplane drawing, machine shop practice and sheet metal work.

2. Inasmuch as there is sufficient classroom space for all academic subjects, it does not seem wise to duplicate these areas in the form of a technical high school but a technical department, as mentioned above, associated with a comprehensive high school using the classrooms and the classroom teachers for academic work and the technical department for laboratory and shop practice would provide for the students the same training as a technical high school without isolating them from the rest of the student body.
3. A technical department set up as indicated above would provide an opportunity for all college preparatory students to participate in shop activities during their unassigned hours or after the close of a school session. The technical department should be made available to all students after the closing of the regular session so that the large number of students who could not participate in this work during the regular school hours would not be deprived entirely of this privilege.
4. The technical department should be open evenings in connection with the evening high school with properly

the first time I have ever seen a single bird

in the sky, and I am sure it was a bird.

It was a large, dark bird, with a long tail.

The next morning I went to the beach again, and found a small gull sitting on a rock. It was a small gull, and it was sitting on a rock. The beach was very sandy, and there were many birds on the sand.

The next day I went to the beach again, and found a small gull sitting on a rock. It was a small gull, and it was sitting on a rock. The beach was very sandy, and there were many birds on the sand.

The next day I went to the beach again, and found a small gull sitting on a rock. It was a small gull, and it was sitting on a rock. The beach was very sandy, and there were many birds on the sand.

The next day I went to the beach again, and found a small gull sitting on a rock. It was a small gull, and it was sitting on a rock.

The next day I went to the beach again, and found a small gull sitting on a rock. It was a small gull, and it was sitting on a rock.

The next day I went to the beach again, and found a small gull sitting on a rock.

trained instructors so that students who had been unable to take shop work while in high school might have this opportunity to acquire fundamental skills. There is always a danger of a technical department evening class becoming a manufacturing plant for people who are employed during the day but want an opportunity to make furniture for their homes in the evening. This is not the purpose or plan of a high school technical department and it should be understood that all applicants should be interviewed and all applications approved individually by the head master of this department or some other person who thoroughly understands the objectives of such a department.

5. Preliminary estimates indicate that the cost of a department, as herein outlined, would be approximately \$300,000.00 compared with \$1,000,000.00 to \$2,000,000.00 for a technical high school.



THE PUBLIC SCHOOLS OF THE CITY OF WORCESTER, MASSACHUSETTS

42

SUPERINTENDENT  
THOMAS F. POWER



ASSISTANT SUPERINTENDENTS  
FRED J. BRENNAN  
GEORGE H. BOYDEN

PERCY F. MARSAW, DIRECTOR

167 COMMERCIAL STREET, WORCESTER 8

DEPARTMENT OF INDUSTRIAL ARTS

December 5, 1945

Dear Sir:

We are contemplating a new technical high school in Worcester, Massachusetts. With this in mind, I am making a survey of the industrial needs of our city and attempting to see how a technical high school would meet these needs.

At the same time, I am doing a thesis for my master's degree at Boston University and some of the material will be used in this thesis.

I would appreciate receiving your school handbook, program of studies and any other printed or mimeographed material which would explain your courses of study and their contents.

If there is a charge for this material, please indicate (stamped envelope enclosed) and I shall remit same.

Thank you.

Sincerely,

Percy F. Marsaw

PM/mj  
Encl.

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CHECK SHEET-No. 1

Listed below are the 15 occupational groups which are shown by the United States Census to be the most common in Worcester. Will you please fill in the numbers employed in these occupations within your industry?

	Male	Female	Male	Female
Clerks and Stenographers			Machinists and Mechanics	
Salesmen			Molders	
Sales Engineers			Painters	
Designers			Patternmakers	
Draftsmen			Plumbers	
Shop Superintendents			Printers	
Shop Foremen			Related Non- Mechanical	
Electricians				

Total number employed (Male) \_\_\_\_\_ (Female) \_\_\_\_\_

Check if you wish your information kept confidential : ( )

Check if you wish a copy of the completed survey ( )

Thank you.

Percy F. Marsaw  
Director of Industrial Arts



THE PUBLIC SCHOOLS OF THE CITY OF WORCESTER, MASSACHUSETTS

44

SUPERINTENDENT  
THOMAS F. POWER

PERCY F. MARSAW, DIRECTOR



ASSISTANT SUPERINTENDENTS  
FRED J. BRENNAN  
GEORGE H. BOYDEN

167 COMMERCIAL STREET, WORCESTER 8

DEPARTMENT OF INDUSTRIAL ARTS

Dear Sir:

I am making a survey of occupations in Worcester to determine the number of male and female employees in various activities. This survey is to help establish the educational needs in our city. Much of the information will be assembled for a thesis at Boston University. The final survey will be mimeographed for distribution.

Since yours is one of the major industries of Worcester, I am asking your help in securing the needed information. Any assistance you may give would be greatly appreciated.

I am enclosing a check sheet and a self-addressed envelope. I would appreciate your making out the check sheet and returning it to me. If you desire, your figures will be held confidential and will be absorbed so as not to reveal the identity of their source.

Thank you for your courtesy.

Yours very truly,

Percy F. Marsaw

PM/mj  
Encls.

John Foster

and other prominent members of Congress. In addition, a coalition of 100  
members of Congress, including both major party leaders and conservative  
Democrats, sent a letter to the House and Senate leadership calling for a  
repeal of Title II of the ADA. The letter was signed by 70 House members  
and 30 Senate senators.

Senate Republicans have held up the bill in committee, arguing  
that it would interfere with state and local governments' ability to provide  
services to disabled individuals. They also argue that the bill would  
allow disabled individuals to sue for discrimination under Title II.  
However, the ADA has been upheld in court numerous times and  
has been found to be constitutional. The bill's supporters argue that  
the ADA is a civil rights law, not a disability rights law, and that it  
protects all individuals from discrimination based on race, gender, and  
disability. They also argue that the bill would not interfere with state  
and local governments' ability to provide services to disabled individuals.

John Foster, 202-555-1234, john.foster@congress.gov

John Foster, 202-555-1234

John Foster, 202-555-1234

John Foster  
202-555-1234

INTERVIEW FORMTalents, Abilities, Skills and Education Desirable in Candidates for EmploymentMANUAL

1. Should be able to use HAND TOOLS (hammer, saw, wrench).
2. Should be able to use BENCH TOOLS (plane, drill, file).
3. Should be able to use MACHINE TOOLS (lathe, shaper, planer).
4. Should be able to use SPECIAL MACHINE TOOLS (turret lathe, broach, gang miller).
5. Should be able to do HAND JOBS REQUIRING HIGH DEGREE OF SKILL (tool making, gage making, precision grinding).

DRAWING

1. Should be able to read BLUEPRINTS.
2. Should be able to make 3-VIEW PROJECTIONS (simple objects, rectangular & circular).
3. Should be able to make 3-VIEW PROJECTIONS & DIMENSION THEM PROPERLY.
4. Should be able to make PICTORIAL DRAWINGS - MECHANICALLY (isometric, cabinet).
5. Should be able to make ASSEMBLY DRAWINGS FROM DETAILS.
6. Should be able to make DESIGNS FOR SIMPLE DEVICES (tools, fittings).
7. Should be able to make DESIGNS FOR COMPLETE MACHINES. (large machine layouts).
8. Should be able to CREATE FACTORY LAYOUTS & DESIGNS FOR NEW PRODUCTS.

MATHEMATICS

1. Should be able to do SIMPLE MATHEMATICAL PROCESSES (add, subtract, multiply and divide).
2. Should be able to do ADVANCED MATHEMATICAL PROCESSES (square root, ratio, compound interest).



INTERVIEW FORM (Continued)MATHEMATICS (Concluded)

3. Should be able to do SIMPLE ALGEBRAIC PROCESSES  
(linear equations).
4. Should be able to do MORE DIFFICULT ALGEBRAIC PROCESSES  
(simultaneous linear equations).
5. Should be able to do DIFFICULT ALGEBRAIC PROCESSES  
(quadratic equations, logarithms).
6. Should be able to do ADVANCED ALGEBRA  
(determinants, permutations, infinite series).
7. Should be able to do PLANE TRIGONOMETRY.
8. Should be able to do SPHERICAL TRIGONOMETRY.
9. Should be able to do CALCULUS.

READING

1. Should be able to read CURRENT MAGAZINES & DAILY PAPER  
(Life, American Home, Liberty).
2. Should be able to read MECHANICAL PAPERS  
(Popular Mechanics, Popular Science).
3. Should be able to read TECHNICAL PAPERS  
(Scientific Journals, Engineering Journals).

WRITING

1. Should be able to write NECESSARY DATA  
(job cards, invoices, orders).
2. Should be able to write MECHANICAL ARTICLES  
(for Popular Mechanics, Popular Science).
3. Should be able to write TECHNICAL PAPERS  
(theses, scientific research articles).

EXECUTIVE

1. Should be able to SUPERVISE DIVISIONS OF PLANT.
2. Should be able to SUPERVISE PLANT ACTIVITIES.
3. Should be able to MANAGE FINANCIAL AFFAIRS OF PLANT.

## Geographical distribution

The genus *Leucosoma* is distributed throughout the Americas from southern Canada to northern Argentina. It is most abundant in the United States, particularly in the West. The species are found in a variety of habitats, including forests, woodlands, and open areas. They are often associated with streams and rivers.

*L. annulipes* is a common species in the eastern United States, particularly in the Southeast. It is found in a variety of habitats, including forests, woodlands, and open areas. They are often associated with streams and rivers.

*L. annulipes* is a common species in the eastern United States, particularly in the Southeast. It is found in a variety of habitats, including forests, woodlands, and open areas. They are often associated with streams and rivers.

This is probably a reference to *L. annulipes*, which is a common species in the eastern United States, particularly in the Southeast. It is found in a variety of habitats, including forests, woodlands, and open areas. They are often associated with streams and rivers.

INTERVIEW FORM (Concluded)SCIENTIFIC

1. Should understand laws of SCIENCE  
(lever, pulley, belts).
2. Should understand laws of MECHANICS  
(linkages, velocities, accelerations).
3. Should understand ELECTRICITY  
(simple circuits, ignition).
4. Should understand ELECTRONICS  
(electronic control, vacuum tube operations).
5. Should understand HYDRAULICS.  
(pressure & release control).

EDUCATION

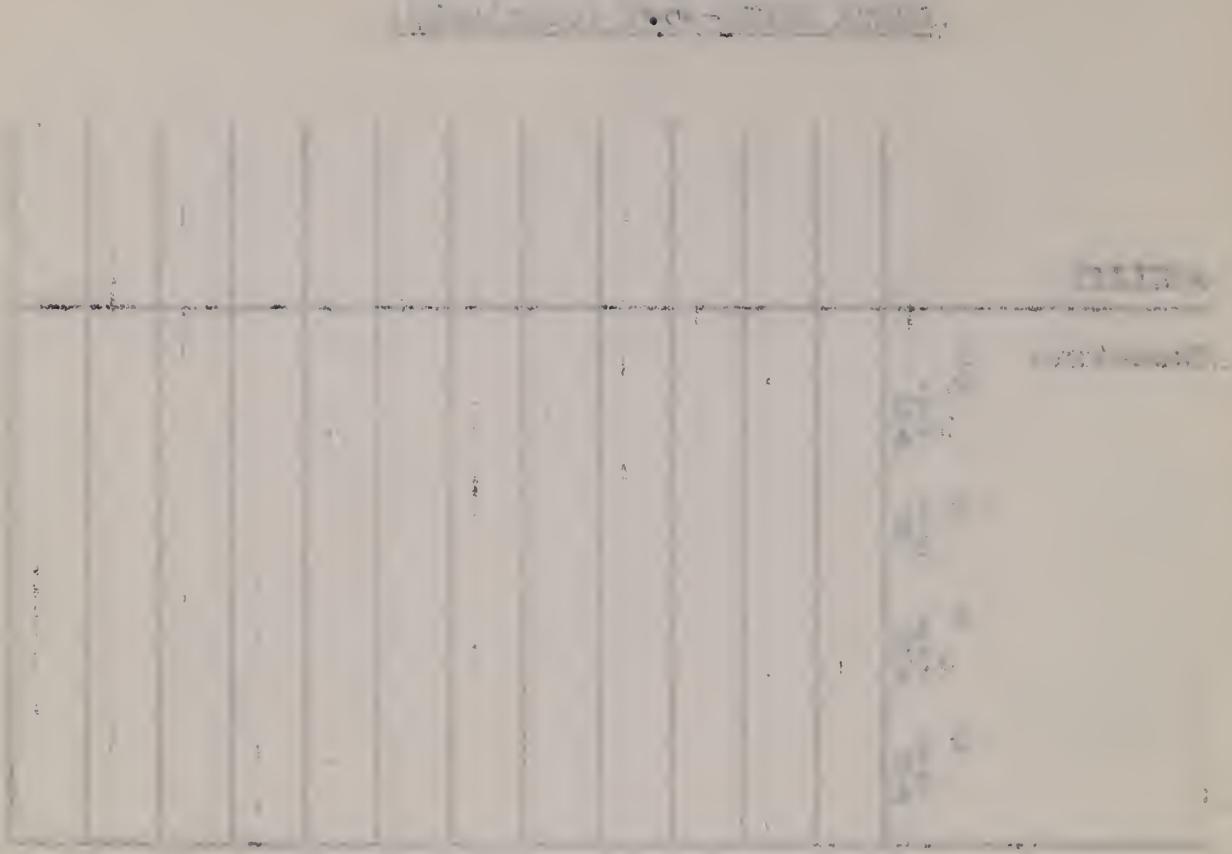
1. Should be graduate of GRAMMAR SCHOOL.
2. Should have 1 year of HIGH SCHOOL.  
2 years  
3 years  
4 years
3. Should have 1 year of TRADE SCHOOL.  
2 years  
3 years
4. Should have 1 year of COLLEGE.  
2 years  
3 years  
4 years
5. Should have 1 year of APPRENTICESHIP.  
2 years  
3 years







**CHECK SHEET-No.2 (Concluded)**





Q. 3. 8. 2. 2.

16.  
17.



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